IN THE CLAIMS:

1-69. (Cancel)

70.   (Previously Presented) Method for operating a directly injecting internal combustion diesel engine including the following steps:

-       operating the internal combustion engine in a first operating region corresponding to low partial loads, with essentially homogeneous mixture combustion and late fuel injection, the latter starting in a range of about 50° to 5° crank angle before top dead center of a compression phase;

-       operating the internal combustion engine in a second operating region corresponding to medium partial loads, with low-temperature mixture combustion and even later injection than in the first operating region, said fuel injection starting in a range of about 2° crank angle before top dead center to about 20° crank angle after top dead center of the compression phase;

-       with fuel being injected into a combustion chamber in the first operating region via first injection orifices and in the second operating region at least via second injection orifices of an injection valve.

71.   (Previously Presented) Method according to claim 70, wherein in the first operating region fuel is injected at a lower flow rate than in the second operating region.

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72. (Previously Presented) Method according to claim 70, wherein in the first and second operating region fuel is injected in a shape of fuel jets forming a conical surface, an apex angle of the cone in the first operating region differing from that in the second operating region, preferably by being smaller in the former.

73. (Previously Presented) Method according to claim 72, wherein the apex angle of the cone in the first operating region is smaller than in the second operating region.

74. (Previously Presented) Method according to claim 70, wherein in the second operating region exhaust gas is re-circulated with an exhaust gas recirculation rate of 20% to 40%.

75. (Previously Presented) Method according to claim 70, wherein fuel injection in the second operating region uses an injection pressure of at least 1,000 bar.

76. (Previously Presented) Method according to claim 70, wherein fuel injection in the first operating region uses an injection pressure between 400 to 1,000 bar.

77. (Previously Presented) Method according to claim 70, wherein in the first operating region a main part of combustion lies in a range from − 10° to 10° crank angle after top dead center.

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78.   (Previously Presented) Method according to claim 70, wherein in a third operating region corresponding to high partial load or full load, a beginning of the main part of fuel injection takes place in a range from -10° to 10° crank angle after top dead center.

79.   (Previously Presented) Method according to claim 78, wherein at least in the third operating region internal exhaust gas recirculation is performed by opening the intake valve during the exhaust phase and/or opening the exhaust valve during the intake phase.

80.   (Previously Presented) Method according to claim 78, wherein an effective mean pressure in the third operating region is at least 5.5 bar.

81.   (Previously Presented) Method according to claim 78, wherein in the third operating region multiple injection is used.

82.   (Previously Presented) Method according to claim 78, wherein in the third operating region the exhaust gas recirculation rate is 30% at most.

83.   (Previously Presented) Method according to claim 78, wherein in the third operating region the exhaust gas recirculation rate is 10% to 20%.

84.   (Previously Presented) Method according to claim 78, wherein in the third operating region fuel is injected through first and/or second injection orifices.

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85.   (Previously Presented) Method according to claim 70, wherein an overall air ratio lies between 1.0 and 2.0.

86.   (Previously Presented) Method according claims 70, wherein exhaust gas recirculation is performed externally and/or internally.

87.   (Previously Presented) Method according to claim 70, wherein a swirl value is varied in at least one operating region depending on load and engine speed.

88.   (Previously Presented) Method according to claim 70, wherein an effective compression ratio is varied by shifting a closing time of at least one intake valve.

89.   (Previously Presented) Method according to claim 70, wherein at least in the first operating region internal exhaust gas recirculation is performed by opening the intake valve during the exhaust phase and/or opening the exhaust valve during the intake phase.

90.   (Previously Presented) Method according to claim 70, wherein changeover from the first to the second operating region, respectively from the second to the first operating region, is initiated by reducing, respectively increasing, the exhaust gas recirculation rate.

91.   (Previously Presented) Method according to claim 70, wherein changeover from the first to the second operating region or vice versa is initiated by reducing the internal or external exhaust gas recirculation

rate and by retarding a beginning of injection, respectively by increasing the exhaust gas recirculation rate and advancing the beginning of injection.

92. (Previously Presented) Method according to claim 70, wherein a decrease of the required exhaust gas recirculation rate on changing from the first to the second operational region is achieved by shifting the opening and/or closing time of the intake valve towards late.

93. (Previously Presented) Method according to claim 70, wherein an effective mean pressure in the first operating region is between 0 to 6 bar.

94. (Previously Presented) Method according to claim 70, wherein an effective mean pressure in the second operating region is between 3.5 to 8 bar.

95. (Previously Presented) Method according to claim 70, wherein a maximum permitted injection volume is computed from a minimum permitted air/fuel ratio and an actually measured fresh-air mass or an actual air/fuel ratio.

96. (Previously Presented) Method according to claim 70, wherein at least one actual value of a combustion parameter required for controlling combustion is computed as a weighted mean of the values in preceding individual cycles.

97.　(Previously Presented)　Method according to claim 70, wherein at least one control parameter of a combustion controller is adapted as a function of a desired target value.

98.　(Previously Presented)　Method according to claim 70, wherein during at least one deceleration phase of the internal combustion engine the intake flow is cut off, and unthrottled exhaust gas recirculation is carried out.

99.　(Previously Presented)　Method for operating a directly injecting diesel internal combustion engine with at least one piston reciprocating in a cylinder, where the internal combustion engine is operated in such a way that fuel combustion essentially occurs at a local temperature below a temperature threshold of NO_x formation and with a local air ratio above a limit of particulate formation, fuel injection starting in a range of 2° crank angle before top dead center to about 10° crank angle after top dead center of the compression phase and exhaust gas being re-circulated at a rate of 20% to 40%, and where a piston with at least one squish surface and a toroidal piston recess and a constriction in the transition area between squish surface and piston recess is provided, and where on an upward stroke of the piston a squish flow directed from the outside into the piston recess is created and a turbulent base flow is initiated in the piston recess, and where the fuel is at least for a greater part injected into the toroidal piston recess and transported along a side

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wall of a piston recess and/or along the piston bottom, evaporating at least partially along the way.

100. (Previously Presented) Method according to claim 99, wherein in at least one operating region an intake flow with a swirl amounting to a swirl value ≥1 is generated in the cylinder, and the fuel is transported by the squish flow along the side wall of the piston recess towards the piston bottom, evaporating at least partly along the way, and along the piston bottom to the center of the piston recess.

101. (Previously Presented) Method according to claim 99, wherein in at least one operating region a swirl-free intake flow, with a swirl value <1, is generated in the cylinder, and the fuel is transported by the squish flow from the center of the piston recess along the piston bottom to the side wall of the piston recess and onwards to the constriction of the piston recess, evaporating at least partly along the way.

102. (Previously Presented) Method according to claim 99, wherein fuel is injected in a direction of the constriction of the piston recess, an intersection point of a jet axis of at least one injection jet at the start of injection lying for a great part of a fuel volume in an area between a side wall of the piston recess and the squish surface, which area comprises an overhanging area of the side wall, the constriction and an inflow area between squish surface and constriction.

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103. (Previously Presented) Method according to claim 99, wherein fuel injection is performed at an injection pressure of 500 to 2,500 bar.

104. (Previously Presented) Method according to claim 99, wherein the overall air ratio is set between 1.0 and 2.0.

105. (Previously Presented) Method according to claim 99, wherein the closing time of at least one intake valve of at least one cylinder in at least one operating region is shifted towards early or late.

106. (Previously Presented) Method according to claim 99, wherein a maximum permitted injection volume is computed from a minimum permitted air/fuel ratio and an actually measured fresh-air mass or an actual air/fuel ratio.

107. (Previously Presented) Method according to claim 99, wherein at least one actual value of a combustion parameter required for controlling combustion is computed as a weighted mean of the values in preceding individual cycles.

108. (Previously Presented) Method according to claim 99, wherein at least one control parameter of a combustion controller is adapted as a function of a desired target value.

109. (Previously Presented) Method according to claim 99, wherein during at least one deceleration phase of the internal combustion engine

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the intake flow is cut off, and unthrottled exhaust gas recirculation is carried out.

110. (Previously Presented) Method for operating a directly injecting diesel internal combustion engine with at least one piston reciprocating in a cylinder, where the internal combustion engine is operated in such a way that fuel combustion essentially occurs at a local temperature below the temperature threshold of NO_x formation and with a local air ratio above the limit of particulate formation, fuel injection starting in a range of 50° to 5° crank angle before top dead center of the compression phase and exhaust gas being re-circulated at a rate of 50% to 70%, and where a piston with at least one squish surface and a toroidal piston recess and a constriction in the transition area between squish surface and piston recess is provided, and where on the upward stroke of the piston a squish flow directed from the outside into the piston recess is created, and where the fuel is at least for the greater part injected into the toroidal piston recess and transported by the squish flow along the side wall of the piston recess and/or along the piston bottom, evaporating at least partially along the way.

111. (Previously Presented) Method according to claim 110, wherein in at least one operating region an intake flow with a swirl amounting to a swirl value ≥1 is generated in the cylinder, and the fuel is transported by the squish flow along the side wall of the piston recess towards the piston

bottom, evaporating at least partly along the way, and along the piston bottom to the center of the piston recess.

112. (Previously Presented) Method according to claim 110, wherein in at least one operating region a swirl-free intake flow, with a swirl value <1, is generated in the cylinder and the fuel is transported by the turbulent base flow from the center of the piston recess along the piston bottom to the side wall of the piston recess and onwards to the constriction of the piston recess, evaporating at least partly along the way.

113. (Previously Presented) Method according to claim 110, wherein fuel is injected in a direction of the constriction of the piston recess, an intersection point of a jet axis of at least one injection jet at the start of injection lying for a great part of a fuel volume in an area between a side wall of the piston recess and the squish surface, which area comprises an overhanging area of the side wall, the constriction and an inflow area between squish surface and constriction.

114. (Previously Presented) Method according to claim 113, wherein at low loads the intersection point is located in an overhanging wall area within the piston recess.

115. (Previously Presented) Method according to claim 113, wherein the intersection point is shifted in the direction of the constriction as the load increases.

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116. (Previously Presented) Method according to claim 110, wherein the beginning of injection is advanced as the load increases from a range of 5° to 15° crank angle before top dead center, corresponding to a region of low partial load, to approximately 50° crank angle before top dead center.

117. (Previously Presented) Method according to claim 110, wherein fuel injection is performed at an injection pressure of 500 to 2,500 bar.

118. (Previously Presented) Method according to claim 110, wherein a main part of combustion is located in a crank angle range of 10° before top dead center and 10° after top dead center.

119. (Previously Presented) Method according to claim 110, wherein the overall air ratio is set between 1.0 and 2.0.

120. (Previously Presented) Method according to claim 110, wherein the closing time of at least one intake valve of at least one cylinder in at least one operating region is shifted towards early or late.

121. (Previously Presented) Method according to claim 110, wherein a maximum permitted injection volume is computed from a minimum permitted air/fuel ratio and an actually measured fresh-air mass or an actual air/fuel ratio.

122. (Previously Presented) Method according to claim 110, wherein at least one actual value of a combustion parameter required for controlling combustion is computed as a weighted mean of the values in preceding individual cycles.

123. (Previously Presented) Method according to claim 110, wherein at least one control parameter of a combustion controller is adapted as a function of a desired target value.

124. (Previously Presented) Method according to claim 110, wherein during at least one deceleration phase of the internal combustion engine the intake flow is cut off, and unthrottled exhaust gas recirculation is carried out.

125. (Previously Presented) A directly injecting internal combustion diesel engine with an injection valve for direct fuel injection into the combustion chamber, which injection valve is designed as a double needle nozzle having first and second injection orifices, said first and second injection orifices being controlled separately.

126. (Previously Presented) The internal combustion engine according to claim 125, wherein the first injection orifices have a smaller total flow cross-section than the second injection orifices.

127. (Previously Presented) The internal combustion engine according to claim 125, wherein the axes of the first injection orifices are aligned along

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a first conical surface and the axes of the second injection orifices are aligned along a second conical surface, the apex angle of the first conical surface being smaller than the apex angle of the second conical surface.

128. (Previously Presented) The internal combustion engine according to claim 125, wherein the first and second nozzle needle are coaxial, the first nozzle needle preferably being guided in the second nozzle needle, which is configured as a hollow needle.

129. (Previously Presented) The internal combustion engine according to claim 125, wherein the first and the second nozzle needle are placed in parallel side by side in a nozzle holder.

130. (Previously Presented) The internal combustion engine according to claim 125, wherein the internal combustion engine can be operated in at least one operating region with pulsed supercharging and wherein in at least one intake pipe a quick-acting pulse switching element is provided, said pulse switching element having switching times – from a first extreme position to a second extreme position and back to the first one – of 10 ms at most.

131. (Previously Presented) The internal combustion engine according to claim 130, wherein the pulse switching element is selected from the group flap, slide valve and rotary slide valve.

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132. (Previously Presented) A diesel internal combustion engine with direct injection, in which the beginning of fuel injection can be set in a range of 50° to 5° crank angle before top dead center of the compression phase, and which has an exhaust gas recirculation system with exhaust gas recirculation rates between 50% to 70%, and which is provided with at least one piston reciprocating in a cylinder, said piston having on its top face at least one squish surface and a toroidal piston recess with a constriction, side walls and bottom with essentially concave curvature and an overhanging wall area between side wall and constriction, wherein at least one jet axis of a fuel injection jet of an injection device for the greater part of an injected volume is directed at a beginning of injection towards an area between the side wall and the squish surface, which area comprises the overhanging wall area, the constriction and an inflow area between squish surface and constriction.

133. (Previously Presented) The internal combustion engine according to claim 132, wherein the internal combustion engine can be operated in at least one operating region with pulsed supercharging and wherein in at least one intake pipe a quick-acting pulse switching element is provided, said pulse switching element having switching times – from a first extreme position to a second extreme position and back to the first one – of 10 ms at most.

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134. (Previously Presented) The internal combustion engine according to claim 133, wherein the pulse switching element is selected from the group flap, slide valve and rotary slide valve.

135. (Previously Presented) The internal combustion engine according to claim 132, wherein an intersection point of at least one jet axis of a fuel jet can be varied at a beginning of injection at least between the overhanging wall area and the constriction.

136. (Previously Presented) The internal combustion engine according to claim 132, wherein the piston recess is dimensioned such that a relation $0.5 < D_B/D < 0.7$ is valid for a ratio of maximum piston recess diameter to piston diameter.

137. (Previously Presented) The internal combustion engine according to claim 132, wherein the piston recess is dimensioned such that a relation $0.12 < H_B/D < 0.22$ is valid for a ratio of maximum piston recess depth to piston diameter.

138. (Previously Presented) The internal combustion engine according to claim 132, wherein the piston recess is dimensioned such that a relation $0.7 < D_T/D_B < 0.95$ is valid for a ratio of constriction diameter to maximum piston recess diameter.

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139. (Previously Presented) The internal combustion engine according to claim 132, wherein the inflow area is configured as an annular depression between squish surface and constriction.

140. (Previously Presented) The internal combustion engine according to claim 132, wherein the depression has a plane bottom leading into the piston recess.

141. (Previously Presented) The internal combustion engine according to claim 132, wherein the depression has a depth of between 5% to 15% of a maximum recess depth.

142. (Previously Presented) The internal combustion engine according to claim 145, wherein the depression has an at least partially cylindrical wall.

143. (Previously Presented) The internal combustion engine according to claim 132, wherein a diameter of the depression in the region of the wall is 10% to 20% greater than a diameter of the constriction.

144. (Previously Presented) A diesel internal combustion engine with direct injection, in which the start of fuel injection can be set in a range of 2° crank angle before top dead center and 10° crank angle after top dead center of the compression phase, and which has an exhaust gas recirculation system with exhaust gas recirculation rates between 20% to 40%, and which is provided with at least one piston reciprocating in a cylinder, with the piston having on its top face at least one squish surface

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and a toroidal piston recess, the recess having a constriction, side walls and bottom with essentially concave curvature and an overhanging wall area between side wall and constriction, and where at least one jet axis of a fuel injection jet of the injection device for the greater part of the injected volume is directed at the start of injection towards an area between the side wall and the squish surface, which area comprises the overhanging wall area, the constriction and an inflow area between squish surface and constriction.

145. (Previously Presented) The internal combustion engine according to claim 144, wherein the internal combustion engine can be operated in at least one operating region with pulsed supercharging and wherein in at least one intake pipe a quick-acting pulse switching element is provided, said pulse switching element having switching times – from a first extreme position to a second extreme position and back to the first one – of 10 ms at most.

146. (Previously Presented) The internal combustion engine according to claim 145, wherein the pulse switching element is selected from the group flap, slide valve and rotary slide valve.

147. (Currently Amended) The internal combustion engine according to claim ~~145~~ 144, wherein the piston recess is dimensioned such that a relation $0.5 < D_B/D < 0.7$ is valid for a ratio of maximum piston recess diameter to piston diameter.

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148. (Currently Amended) The internal combustion engine according to claim 145 144, wherein the piston recess is dimensioned such that a relation $0.12 < H_B/D < 0.22$ is valid for a ratio of maximum piston recess depth to piston diameter.

149. (Currently Amended) The internal combustion engine according to claim 145 144, wherein the piston recess is dimensioned such that a relation $0.7 < D_T/D_B < 0.95$ is valid for a ratio of constriction diameter to maximum piston recess diameter.

150. (Currently Amended) The internal combustion engine according to claim 145 144, wherein the inflow area is configured as an annular depression between squish surface and constriction.

151. (Currently Amended) The internal combustion engine according to claim 145 144, wherein the depression has a plane bottom leading into the piston recess.

152. (Currently Amended) The internal combustion engine according to claim 145 144, wherein the depression has a depth of between 5% to 15% of a maximum recess depth.

153. (Currently Amended) The internal combustion engine according to claim 145 144, wherein the depression has an at least partially cylindrical wall.

154. (Currently Amended) The internal combustion engine according to claim ~~145~~ 144, wherein a diameter of the depression in the region of the wall is 10% to 20% greater than a diameter of the constriction.

155. (New) Method according to claim 70, wherein the internal combustion engine is operated in at least one operating region with pulsed supercharging.

156. (New) Method according to claim 70, wherein the closing time of at least one intake valve of at least one cylinder in at least one operating region is shifted towards early or late.